Curriculum Map 2010-2011

Shanghai American School

Chao, Michael / ***IB Math HL Year 1*** / ***High School (Pudong High School)***

June 8, 2011, 12:14PM

	Essential Questions	EAGLES	Knowledge (Content)	Objectives (Skills)	Assessment	Instructional Strategies	Resources Including Technology	Reflections
Functions (Week 1, 6 Weeks)	1. What characteristics/properties are important for the study of functions, regardless of type? 2. What characteristics/properties are used to define or distinguish particular types of functions?		A. Understandings • Familiarity with a variety of types of functions and their properties allows us to describe a wide range of phenomena and situations. • Transformations can be applied to reflect, shift, and stretch the graphs of functions while preserving certain key properties. B. Knowledge • domain, range • inverse functions -- including domain restrictions • quadratic functions -- vertex, axis of symmetry, completing the square, discriminant • exponential and logarithmic functions -- properties, graphs, equations, applications • transformations of functions -- translations, dilations, reflections, absolute value, quotients • complex numbers -- basic operations, complex conjugates, complex rootsi • polynomial functions -- zeros and roots • polynomial division, including synthetic division • Remainder, Factor, and Rational Root Theorems	• Graph functions using technology, or sketch the graph of a function by hand, using knowledge of its properties • Identify the domain and range of a function from its equation or graph • Represent the inverse of a function algebraically, graphically, and numerically, and determine if the inverse is a function • Determine the minimum or maximum value of a quadratic function • Use the discriminant to analyze the nature of the roots of a quadratic equation • Use the properties of logarithmic and exponential functions to solve equations or graph related functions • Represent transformations of functions algebraically, graphically, and numerically • Use technology to fit an equation to a	**Observation** Observations during class assignments -- some recorded in planning book **Other Written Assessments** Homework **Quiz** **Written Test** **Group Work** Class assignments -- see attachments **Parabola investigations project** **Summative: Written Report** practice portfolio project (practice IB Internal Assessment) -- Type I -- mathematical investigation inverse_functions.docx quadratics.docx exponents___logs.docx transformations_i.docx transformations_ii.docx tuition_type_ii.docx unit_1_quiz.docx test_1_0809.docx ch_8_quiz.docx complex_numbers.docx factor_remainder_thms.docx polynomials.docx inequalities.docx	The bulk of most classes has been class work in pairs, with assignments divided into 3 sections: Review (things I expect the students to have mastered already), Review?? (things I expect the students to be familiar with, but not necessarily to have mastered), and Extension. This strategy suits the initial part of the course, in which most of the major concepts are familiar to the students, but where they will have to extend their understanding to more advanced problems/applications. During each class, we also discuss selected problems as a larger group.	Textbooks: 1. Main text -- Paul Urban, John Owen, David Martin, Robert Haese, Sandra Haese, and Mark Bruce, *Mathematics for the International Student, Mathematics HL (Core)*, Haese and Harris Publications, Adelaide, Australia, 2004, ISBN 1-876543-09-4. 2. Supplementary text -- Bill Roberts, and Sandy MacKenzie, Mathematics Higher Level for the IB Diploma, Oxford University Press, Oxford, UK, 2007, ISBN-13: 978-0-19-915226-1 Handouts -- see attachments in Assessment section Technology: TI graphing calculators are used almost every day. Students used charts and statistical functions in Excel on the mini-project for this unit.	

			set of data, and use the properties of functions to comment on the suitability of various models			
Trigonometry (Week 7, 5 Weeks)	1. How do we get from triangles to waves? 2. What analytic tools do we need to study and understand periodic phenomena?	A. Understandings • Trigonometry is the primary mathematical tool used in the study of periodic phenomena. • The unit circle is the conceptual bridge between geometric trigonometry and the study of trigonometric functions. B. Knowledge • Geometric trigonometry -- Law of Cosines, Law of Sines, Ambiguous Case (review) • Sine/cosine functions and graphs -- amplitude, period, phase shift • Other trig functions and graphs • Inverse trig functions and graphs • Trig equations • Trig identities -- Pythagorean, sum and difference, double angle, verifying identities • Compound formula (a sin x + b cos x = r cos (x + q))	• Solve (for the missing sides and angles of) triangles, using the Law of Cosines and/or Law of Sines, including the Ambiguous Case • Explain how the sine and cosine functions are derived from the unit circle as circular functions • Analyze the properties of trigonometric and inverse trigonometric functions • Sketch the graphs of trigonometric and inverse trigonometric functions • Solve trigonometric equations • Prove trigonometric identities • Apply trigonometric functions to model real-life periodic phenomena	**Quiz** **Observation** **Group Work** In-class assignments -- see attachments **Written Test** **Other Written Assessments** Homework ch_12_triangle_trig.docx unit_circle_trig.docx applications_of_radians.docx sin_cos_graphs.docx other_trig_functions.docx inverse_trig.docx trig_sum_and_diff.docx trig_equations.docx compound_formula.docx unit_3_quiz.docx test_3_0809.docx	As in the first two units, classes were centered around small-group work, with the class pulled together for discussions about key concepts or particular problems or problem-solving techniques.	Textbooks: 1. Main text -- Paul Urban, John Owen, David Martin, Robert Haese, Sandra Haese, and Mark Bruce, *Mathematics for the International Student, Mathematics HL (Core)*, Haese and Harris Publications, Adelaide, Australia, 2004, ISBN 1-876543-09-4. 2. Supplementary text -- Bill Roberts, and Sandy MacKenzie, Mathematics Higher Level for the IB Diploma, Oxford University Press, Oxford, UK, 2007, ISBN-13: 978-0-19-915226-1 Handouts -- see attachments in Assessment section Technology: TI graphing calculators are used almost every day.
Differential Calculus (Week 12, 4 Weeks)	1. How do you find the slope of a curve? 2. What mathematical tools do we need to study applications involving rates of change?	A. Understandings • The derivative represents the slope of a function at any point. • Differential calculus is the primary mathematical tool for applications involving instantaneous rates of change. B. Knowledge	1. Interpret the derivative of a function as its slope or as a rate of change in various contexts. 2. Determine the derivative of a function from first principles. 3. Calculate the	**Quiz** **Written Test** **Group Work** In-class assignments -- see handouts **Other Written Assessments** Homework **Observation**	As in the first three units, classes were centered around small-group work, with the class pulled together for discussions about key concepts or particular problems or problem-solving techniques.	Textbooks: 1. Main text -- Finney, Demana, Waits, and Kennedy, *Calculus: Graphical, Numerical, Algebraic*, 3rd edition, Pearson/Prentice Hall, Boston, USA, 2007, ISBN 0-13

B. Knowledge

- Derivatives from first principles
- Derivative rules -- power, product, quotient, chain, etc.
- Derivatives of common functions
- Tangent and normal lines
- Velocity and acceleration as derivatives

3. Calculate the derivatives of common functions and combinations of functions.
4. Use derivatives to solve problems involving tangent and normal lines.
5. Differentiate implicitly to find the slope of a graph whose function is not explicitly given.
6. Use derivatives to solve problems involving motion in one dimension.

continuity_and_differentiability.docx
implicit_differentiation.docx
rates_of_change.docx
inv_trig_derivatives.docx
trig_derivatives.docx
log_exp_derivatives.docx
tangents_and_normals.docx
chain_rule.docx
derivative_rules.docx
limits_and_derivatives.docx
intro_to_calc.docx
unit_4_quiz.docx
calc_ch_3_test_0809.docx

2007, ISBN 0-13-201408-4
2. Supplementary text -- Paul Urban, John Owen, David Martin, Robert Haese, Sandra Haese, and Mark Bruce, *Mathematics for the International Student, Mathematics HL (Core)*, Haese and Harris Publications, Adelaide, Australia, 2004, ISBN 1-876543-09-4.
3. Supplementary text -- Bill Roberts, and Sandy MacKenzie, *Mathematics Higher Level for the IB Diploma*, Oxford University Press, Oxford, UK, 2007, ISBN-13: 978-0-19-915226-1

Handouts -- see attachments in Assessment section

Technology:

TI graphing calculators are used almost every day.

Review and Semester 1 Exam
(Week 16, 2 Weeks)

Differential Calculus -- applications
(Week 18, 4 Weeks)

1. How does calculus expand our ability to analyze a function?
2. What kind of practical situations can be investigated using related rates or optimization?

A. Understandings

- The first derivative allows us to investigate when a function is increasing/decreasing, and to find its critical points.
- The second derivative allows us to investigate the concavity of a graph, and to find its points of inflection.
- Derivatives allow us to model practical applications involving related rates or optimization.

B. Knowledge

1. Determine the critical points of a function, and its global and local extreme points
2. Determine the intervals where a function is increasing/decreasing
3. Determine the points of inflection of a graph
4. Determine the intervals where a graph is concave up/concave down
5. Determine the asymptotes of a graph
6. Apply derivatives to find

Observation

Group Work
In-class assignments -- see handouts

Other Written Assessments
Homework

Quiz

Written Test

first_derivatives_and_graphing.docx
second_derivatives_and_graphing.docx
asymptotes.docx
optimization.docx

As in previous units, classes were centered around small-group work, with the class pulled together for discussions about key concepts or particular problems or problem-solving techniques.

Textbooks:

1. Main text -- Finney, Demana, Waits, and Kennedy, *Calculus: Graphical, Numerical, Algebraic*, 3rd edition, Pearson/Prentice Hall, Boston, USA, 2007, ISBN 0-13-201408-4
2. Supplementary text -- Paul Urban, John Owen, David Martin, Robert Haese, Sandra Haese, and Mark Bruce, *Mathematics*

It's no surprise that the students found this unit considerably more difficult than the previous one, since these applications in general require higher-order critical thinking. This was a unit where I wished I

- Increasing and decreasing functions
- Critical points
- Absolute and relative extrema
- Concavity
- Points of inflection
- Horizontal, vertical, and oblique asymptotes
- Related rates
- Optimization

to find maxima/minima in real-world problems
7. Apply implicit differentiation to solve related rates problems

related_rates.docx
calc_ch_4_quiz_0809.docx
calc_ch_4_test_0809.docx

Bruce, *Mathematics for the International Student, Mathematics HL (Core)*, Haese and Harris Publications, Adelaide, Australia, 2004, ISBN 1-876543-09-4.
3. Supplementary text -- Bill Roberts, and Sandy MacKenzie, *Mathematics Higher Level for the IB Diploma*, Oxford University Press, Oxford, UK, 2007, ISBN-13: 978-0-19-915226-1

Handouts -- see attachments in Assessment section

Technology:

TI graphing calculators are used almost every day.

didn't feel such strong time pressure -- the students could have used more time for ideas to sink in, instead of pretty much doing something new each day. However, especially since we've committed to preparing for the AP Calc AB exam, we don't really have this luxury.

Integral Calculus
(Week 22, 4 Weeks)

1. How do we find the area under a curve?
2. What's so fundamental about the Fundamental Theorem of Calculus?

A. Understandings

- Rectangular area approximations using "infinitely thin" rectangles allow us to investigate the area under a curve.
- Integration and differentiation are inverse operations, as demonstrated in the Fundamental Theorem of Calculus.

B. Knowledge

- Rectangular area approximations/Riemann sums
- Definite integrals
- Antiderivatives/indefinite integrals
- Fundamental Theorem of Calculus
- Trapezoidal Rule for numerical integration

1. Estimate the area under curve using numerical methods -- rectangular or trapezoidal approximations
2. Use the properties of definite integrals to find areas defined in terms of other areas
3. Explain the similarities and differences between areas and definite integrals
4. Determine the antiderivatives of common functions
5. Use the Fundamental Theorem of Calculus to evaluate definite integrals
6. Use the Fundamental Theorem of Calculus to analyze functions (for example, when given the graph of a derivative)

Formative: Observation

Formative: Group Work
In-class assignments -- see handouts

Summative: Written Test

Formative: Other Written Assessments
Homework

intro_to_integral_calculus.docx
definite_integrals.docx
fund_thm_of_calc.docx
antiderivatives_and_ftc_contd.docx
trapezoidal_rule.docx
calc_ch_5_test_0809.docx

As in previous units, classes were centered around small-group work, with the class pulled together for discussions about key concepts or particular problems or problem-solving techniques.

Textbooks:

1. Main text -- Finney, Demana, Waits, and Kennedy, *Calculus: Graphical, Numerical, Algebraic*, 3rd edition, Pearson/Prentice Hall, Boston, USA, 2007, ISBN 0-13-201408-4
2. Supplementary text -- Paul Urban, John Owen, David Martin, Robert Haese, Sandra Haese, and Mark Bruce, *Mathematics for the International Student, Mathematics HL (Core)*, Haese and Harris Publications, Adelaide, Australia, 2004, ISBN 1-876543-09-4.
3. Supplementary text -- Bill Roberts, and Sandy MacKenzie, *Mathematics*

						Higher Level for the IB Diploma, Oxford University Press, Oxford, UK, 2007, ISBN-13: 978-0-19-915226-1 Handouts -- see attachments in Assessment section Technology: TI graphing calculators are used almost every day.
Integral Calculus -- adv techniques & applications (Week 26, 4 Weeks)	1. What types of real-world situations can be modeled with integrals? 2. How can we extend the idea of the sum of infinitely thin slices beyond area to volume and other applications?	A. Understandings • A variety of algebraic techniques can be used to expand the class of functions for which we can find antiderivatives. • Integrals can be applied to a variety of mathematical and real-world applications by extending the idea of "infinitely thin slices." B. Knowledge • u-substitution • integration using other substitutions • integration by partial fractions • integration by parts • area under a curve and area between two curves • volumes of revolution (disk/washer method) • volumes of revolution (shell method) • volumes of other solids with known cross-sections • differential equations using separation of variables • slopefields • recognizing other integral applications using the idea of net change	1. Find antiderivatives using u-substitution 2. Find antiderivatives using other types of substitution 3. Find antiderivatives using the technique of partial fractions (non-repeated linear factors only) 4. Find antiderivatives using integration by parts 5. Calculate the area under a curve or between two curves (with respect to x or y) 6. Calculate volumes of revolution using disks, washers, or cylindrical shells 7. Calculate volumes of solids with known cross-sections 8. Solve separable differential equations (general and particular solutions) 9. Represent differential equations graphically using slopefields 10. Apply integrals to other real-life situations using the concept of net change	**Summative: Written Test** **Formative: Observation** **Summative: Quiz** **Summative: Written Report** IB Portfolio project -- Modeling a functional building **Formative: Group Work** In-class assignments -- see handouts **Formative: Other Written Assessments** Homework u_substitution.docx adv_integration.docx area_variations.docx volume_1.docx volume_2.docx integration_by_parts.docx separable_diff_eq.docx logistic_growth.docx other_integral_apps.docx integration_test_topic_outline.docx integration_quiz.docx calc_ch_6_7_test_0809.docx	As in previous units, classes were centered around small-group work, with the class pulled together for discussions about key concepts or particular problems or problem-solving techniques.	Textbooks: 1. Main text -- Paul Urban, John Owen, David Martin, Robert Haese, Sandra Haese, and Mark Bruce, *Mathematics for the International Student, Mathematics HL (Core)*, Haese and Harris Publications, Adelaide, Australia, 2004, ISBN 1-876543-09-4. 2. Supplementary text -- Finney, Demana, Waits, and Kennedy, *Calculus: Graphical, Numerical, Algebraic*, 3rd edition, Pearson/Prentice Hall, Boston, USA, 2007, ISBN 0-13-201408-4 3. Supplementary text -- Bill Roberts, and Sandy MacKenzie, *Mathematics Higher Level for the IB Diploma*, Oxford University Press, Oxford, UK, 2007, ISBN-13: 978-0-19-915226-1 Handouts -- see attachments in Assessment section Technology: TI graphing calculators

are used almost every day.

AP Calculus exam review (Week 30, 3 Weeks)	No new essential questions -- review	I have included this unit in the curriculum map for this course in order to give a complete timeline. However, since this unit is for AP exam review, with no new content to study, I am leaving certain sections blank.	No new objectives/skills -- review		Review	extbooks: 1. Main text -- Finney, Demana, Waits, and Kennedy, *Calculus: Graphical, Numerical, Algebraic*, 3rd edition, Pearson/Prentice Hall, Boston, USA, 2007, ISBN 0-13-201408-4 2. Supplementary text -- Paul Urban, John Owen, David Martin, Robert Haese, Sandra Haese, and Mark Bruce, *Mathematics for the International Student, Mathematics HL (Core)*, Haese and Harris Publications, Adelaide, Australia, 2004, ISBN 1-876543-09-4. 3. Supplementary text -- Bill Roberts, and Sandy MacKenzie, *Mathematics Higher Level for the IB Diploma*, Oxford University Press, Oxford, UK, 2007, ISBN-13: 978-0-19-915226-1 Handouts Exam practice • Free response questions from APCentral • Multiple choice from various sources Technology: TI graphing calculators are used almost every day.	I am glad that students in this course are having a chance to write the AP Calculus AB exam. Especially for the IB Certificate students, I think it helps in terms of how they see the benefits of taking the course. I am certainly eager to see how they do, and cautiously optimistic. I think you always wish you had more time for review, but at least we had a couple weeks, allowing us to take another look at each of the main sections of the course, and to work on a bunch of practice exams. Students who did not sign up for the AP exam had the option of doing another portfolio assignment, but none did. Perhaps I should have required it for these students,

but I did not want to exclude them from the Calculus review.

Probability (w/combinatorics, seq & series)
(Week 33, 4 Weeks)

What concepts and techniques do we need to learn in order to "count" effectively for probability?

A. Understandings

- Probability is the branch of mathematics that deals with determining the likelihood of uncertain events.
- A variety of sophisticated counting techniques can be employed to enumerate the possibilities for a given situation.
- Conditions and restrictions on events create a nearly endless variety of possible variations for probability problems.

B. Knowledge

- Combinations, permutations, and variations (permutations with repetition, circular permutations)
- Complementary events
- Compound events
- Mutually exclusive events
- Independent events
- Selection with and without replacement
- Conditional probability
- Binomial probability
- Tree diagrams
- Venn diagrams

1. Compute probabilities using combinations and permutations
2. Compute probabilities of complementary, independent, mutuallly exclusive, and/or compound events
3. Compute probabilities involving selection with and without replacement
4. Compute conditional probabilities
5. Compute probabilities resulting from binomial distributions
6. Use appropriate representations for various kinds of probability problems, including tree diagrams and Venn diagrams
7. Interpret probabilistic situations to choose the appropriate concept(s) and/or representation from those listed above

Formative: Group Work
In-class assignments -- see handouts

Summative: Written Test

Formative: Other Written Assessments
Homework

Formative: Observation

Summative: Quiz

probability_tree_diagrams.docx
binomial_probabilities.docx
laws_of_probability.docx
more_probability.docx
unit_8_test__probability___0809.docx

As in previous units, classes were centered around small-group work, with the class pulled together for discussions about key concepts or particular problems or problem-solving techniques.

Textbooks:

1. Main text -- Paul Urban, John Owen, David Martin, Robert Haese, Sandra Haese, and Mark Bruce, *Mathematics for the International Student, Mathematics HL (Core)*, Haese and Harris Publications, Adelaide, Australia, 2004, ISBN 1-876543-09-4.
2. Supplementary text -- A. J. Sadler and D. W. S. Thorning, Understanding Pure Mathematics, Oxford University Press, Oxford, 1987, ISBN 0-19-914243-2

Handouts -- see attachments in Assessment section

Technology:

TI graphing calculators are used almost every day.

This final unit of the year provides a bridge into Year 2, since we will begin with Random Variables and Probability Distributions. This is one of the very interesting and effective aspects about the sequence of topics developed by David S. The beginning of the unit was choppy because of AP exams, but overall the students did a good job, without the loss of momentum some classes seem to experience towards the end of the year.

I have really enjoyed working with this group. They seem excited about learning, enjoy taking on challenges, and support each other's learning. I am looking forward to doing Year 2 with them, which is a very nice

way to head into the summer.

Review and Semester 2 Exam
(Week 37, 2 Weeks)

Updated: 06/01/2011 06:02:06am

Atlas Version 7.2.2